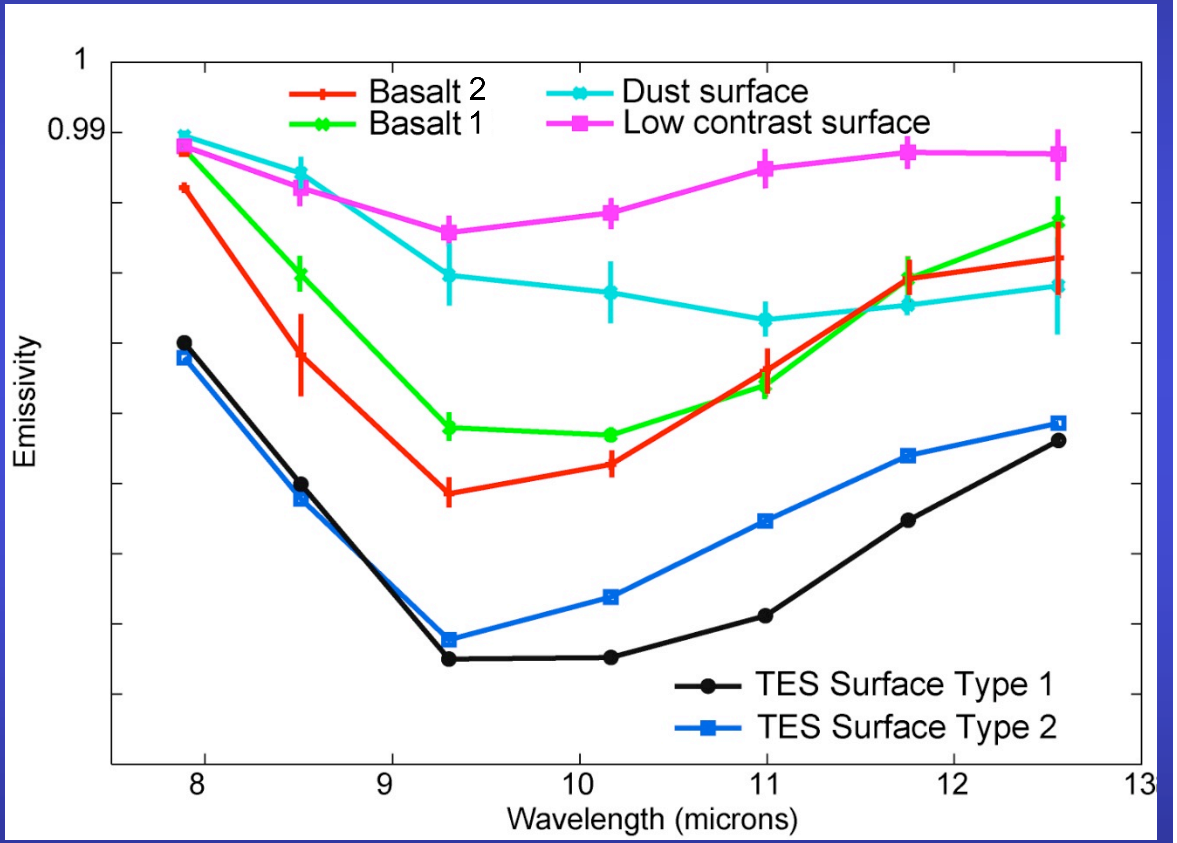
Mawrth THEMIS spectral endmembers

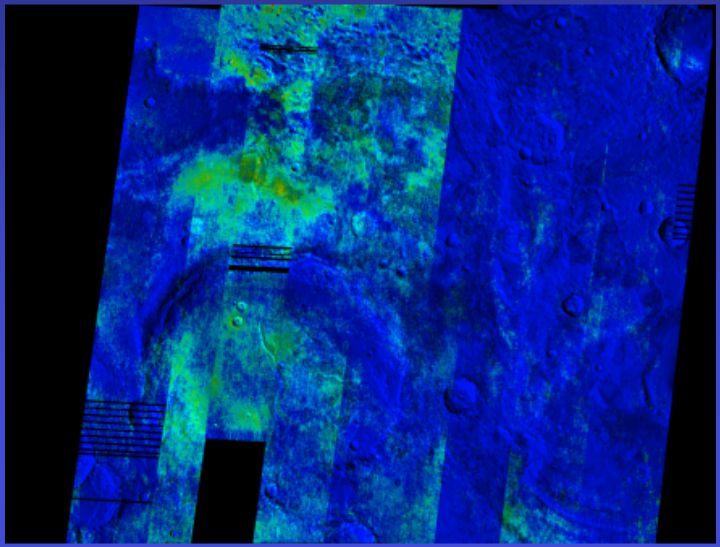
- Basalt 1 surface is similar to TES Surface Type 1
- Basalt 2 surface is similar to TES Surface Type 2
- Dust and blackbody distributions represent varying contributions from dust or varying particle size /surface texture



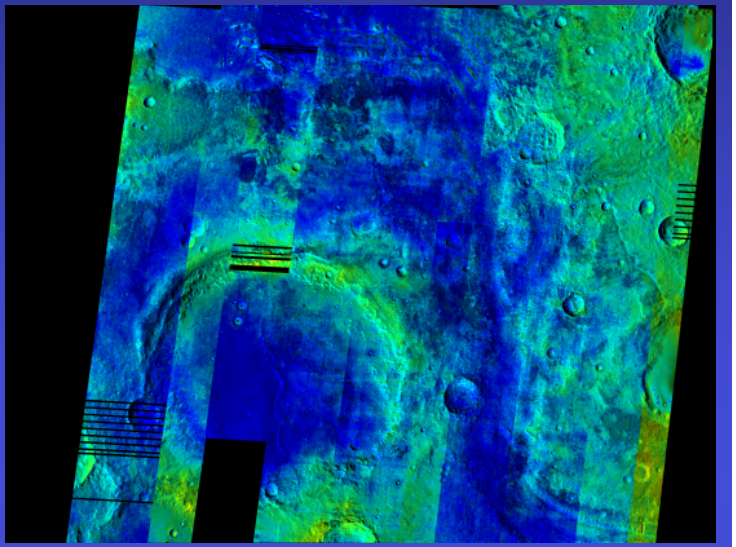
Mawrth Vallis

THEMIS spectral unit mosaics

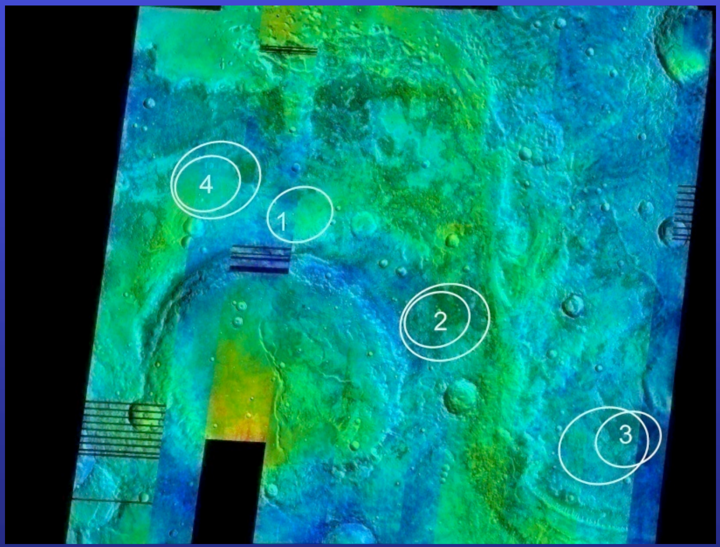
Basalt 1
(0-2.0)



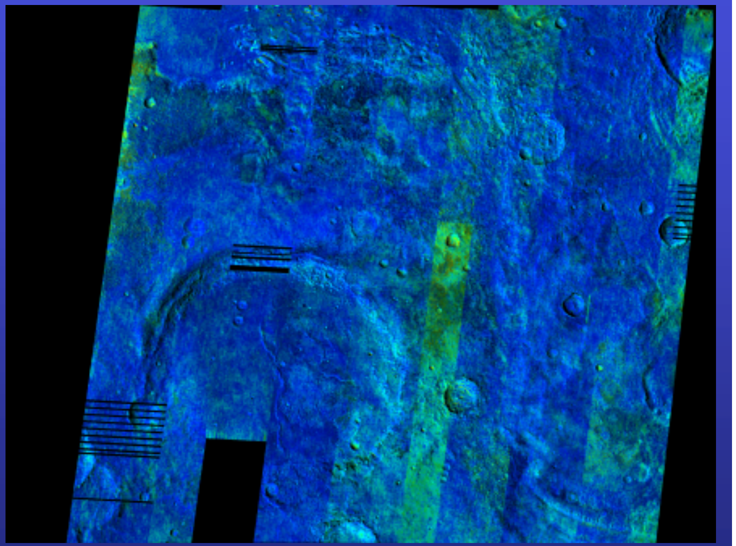
Blackbody/
dust
(0 to 1.3)



Basalt 2
(0-2.3)



RMS Error
(0-0.01)



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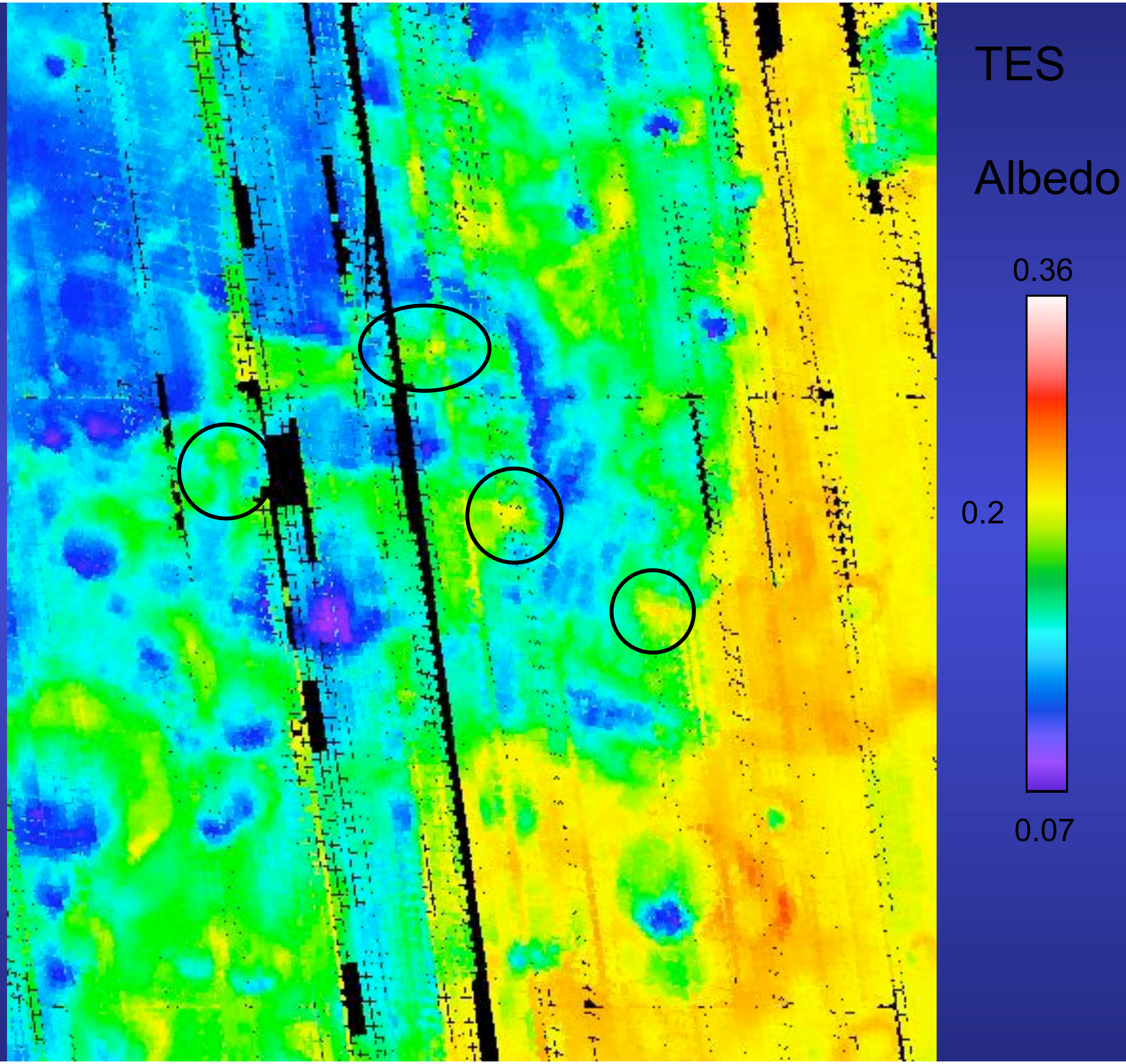
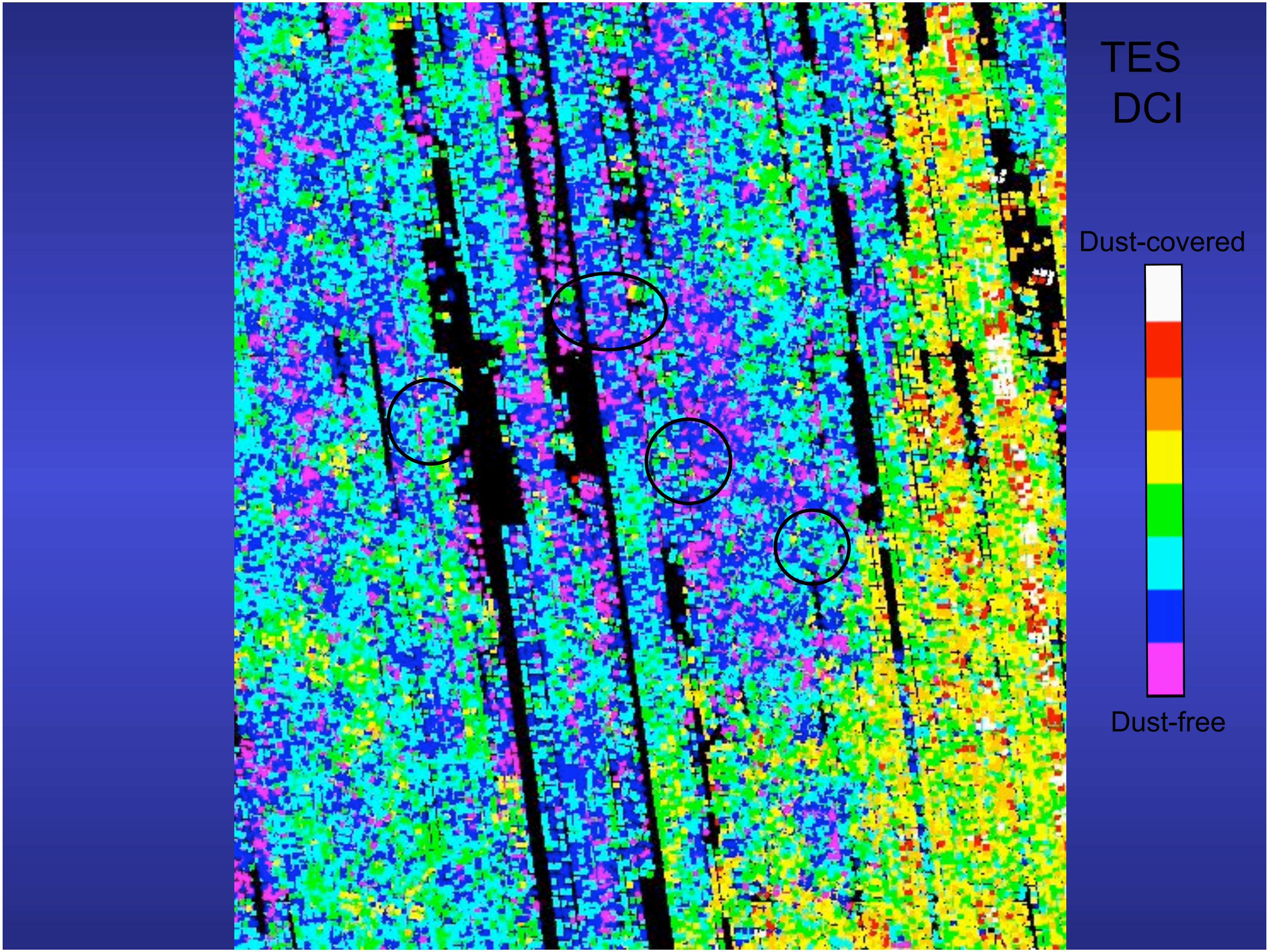
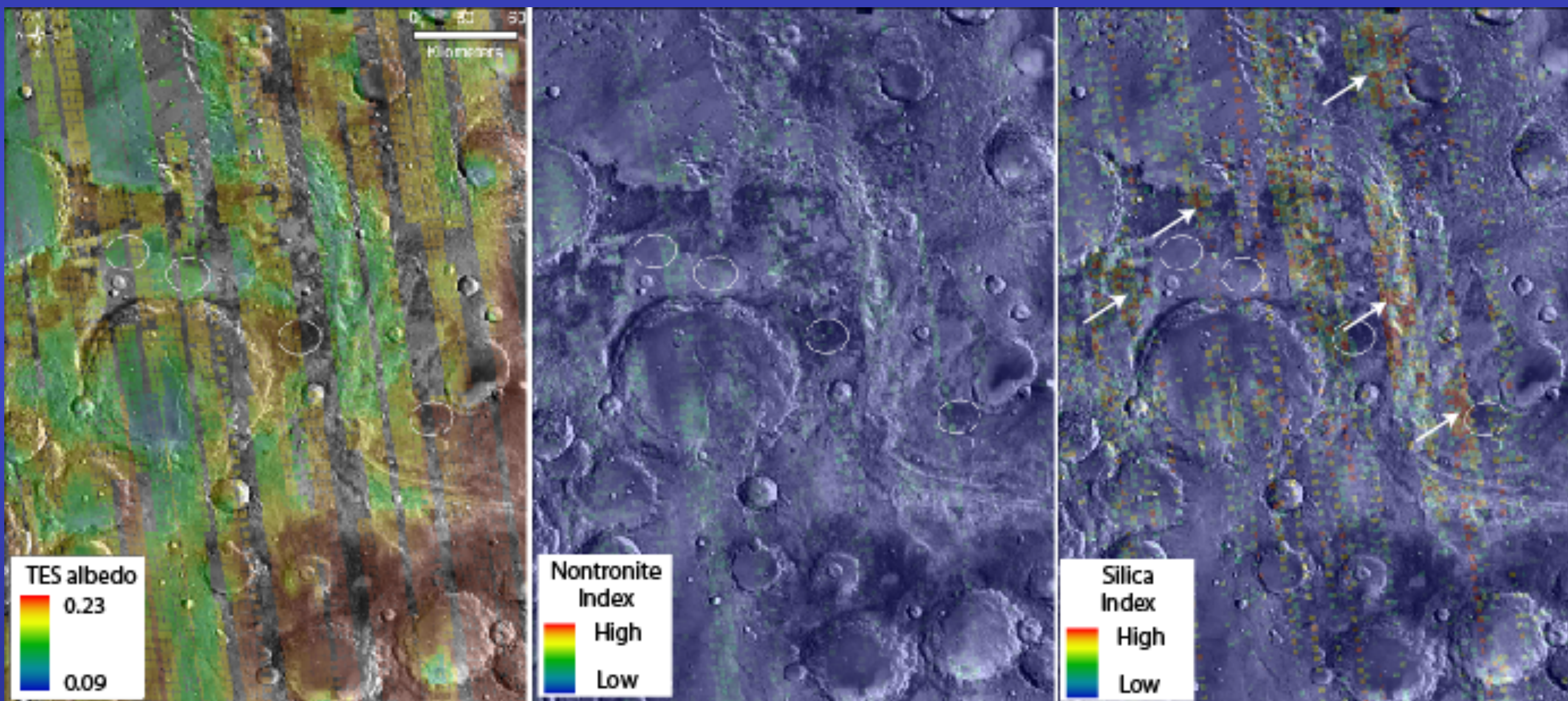
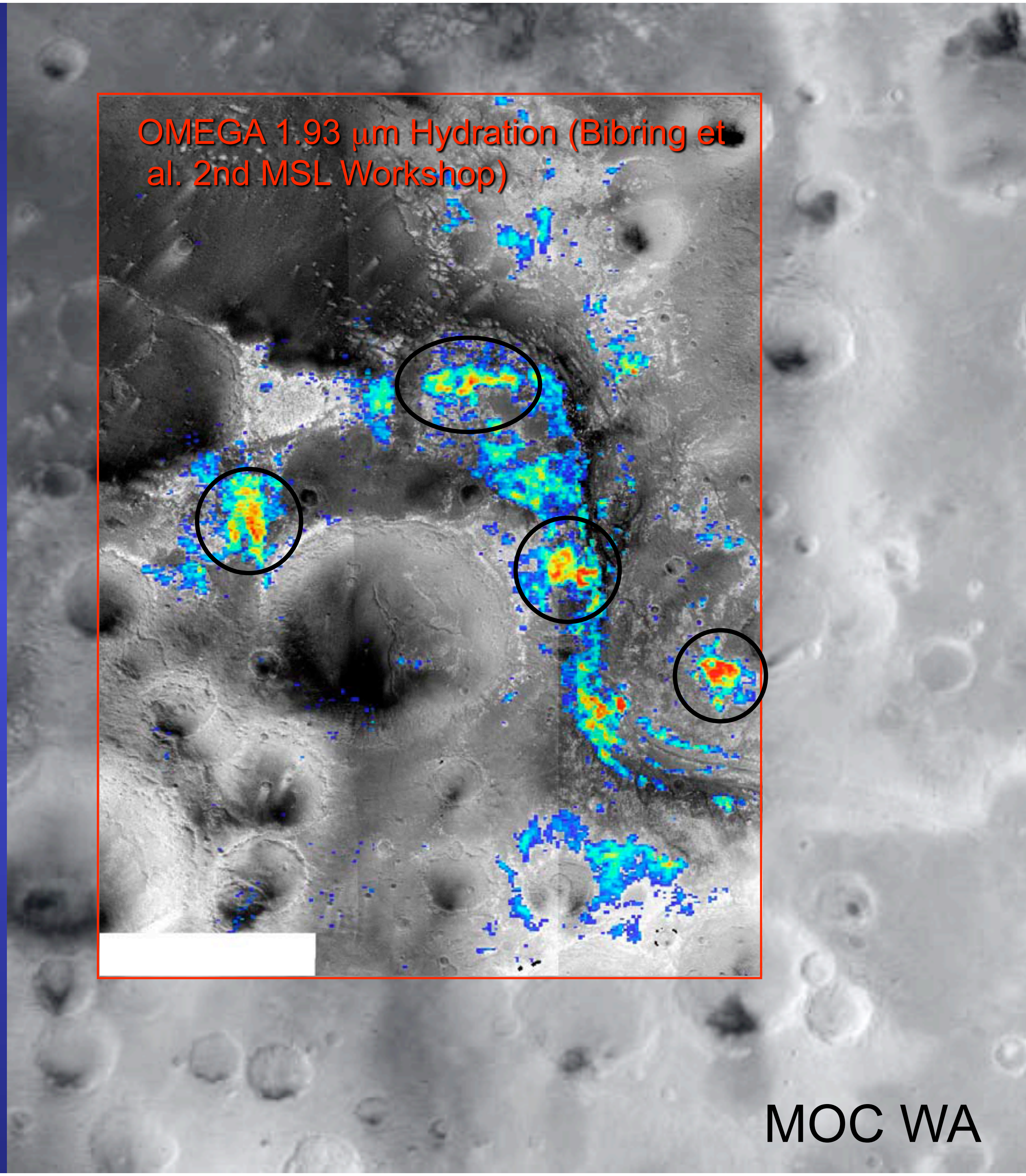

TES
Albedo
0.36
0.2
0.07

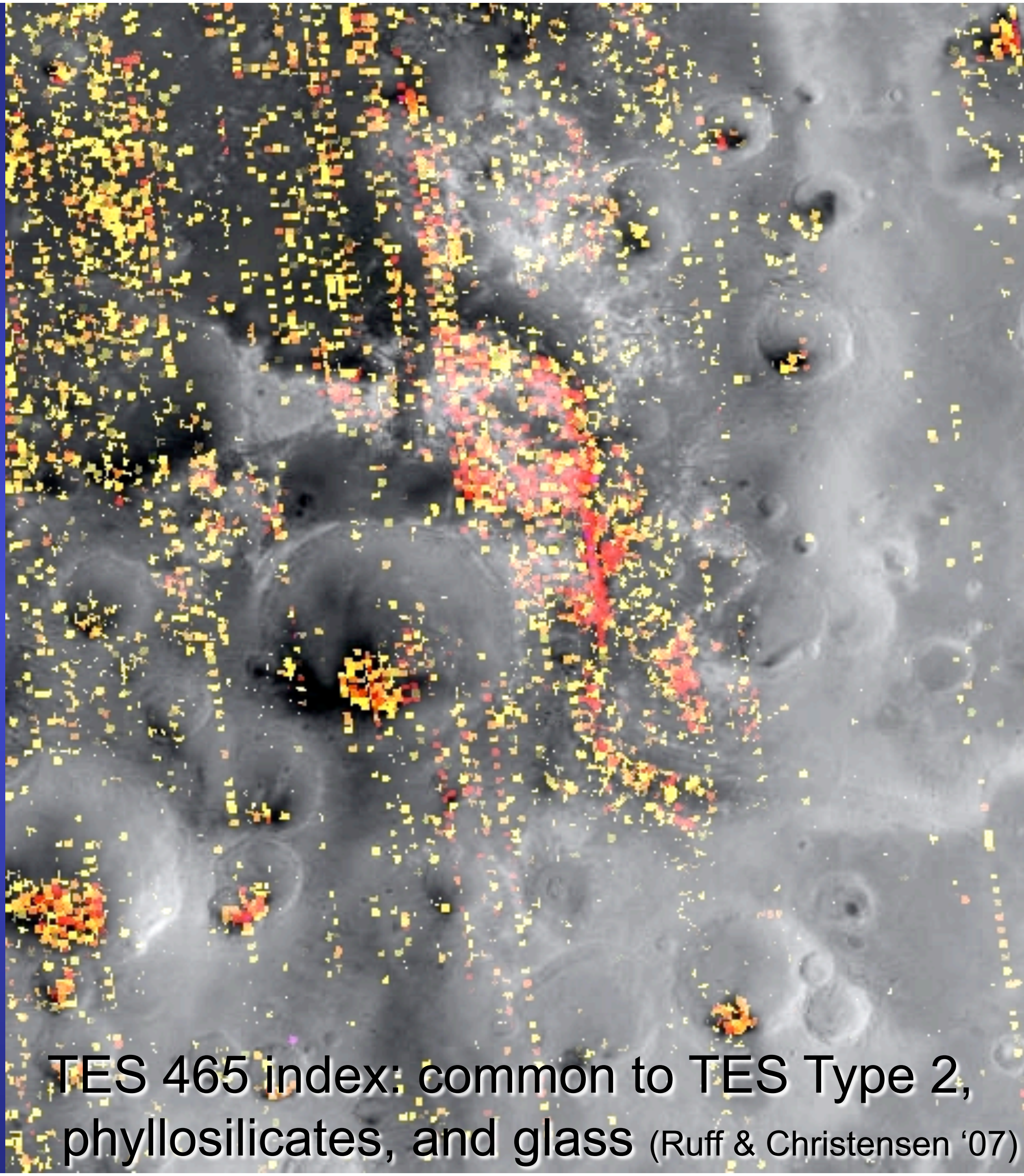

TES
DCI
Dust-covered
Dust-free

Spectral index mapping results



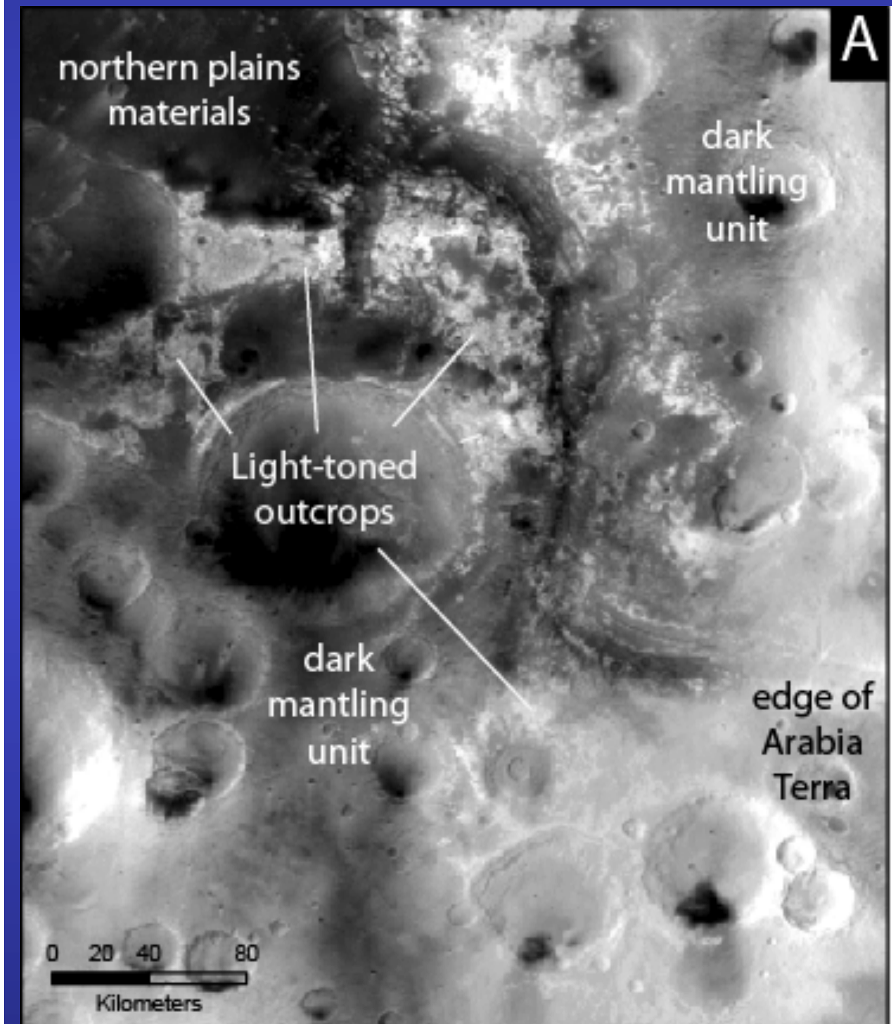
Michalski and Fergason, Icarus (in press)

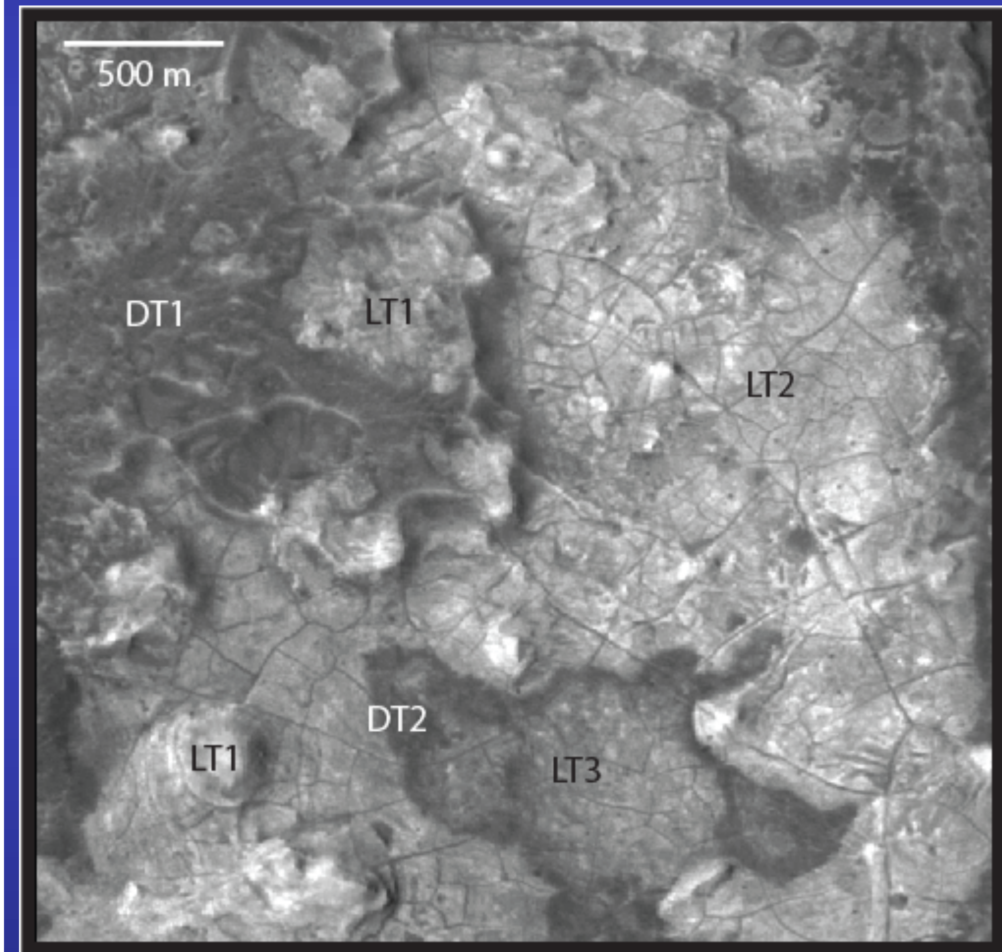

OMEGA 1.93 μm Hydration (Bibring et al. 2nd MSL Workshop)
MOC WA



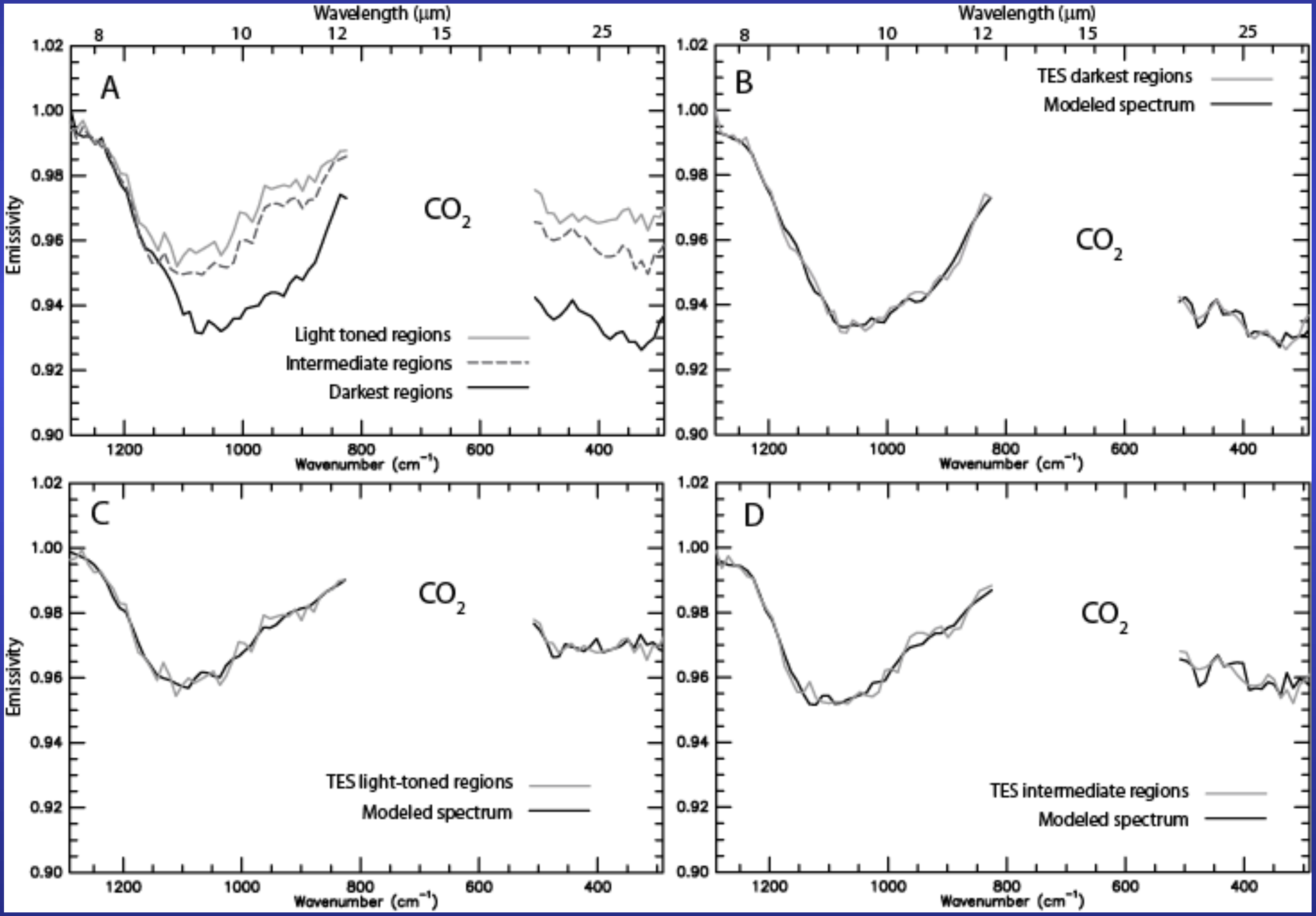
TES 465 index: common to TES Type 2, phyllosilicates, and glass (Ruff & Christensen '07)

Modeling of TES data: Average spectra of light-toned, intermediate-toned, and very dark-toned surfaces





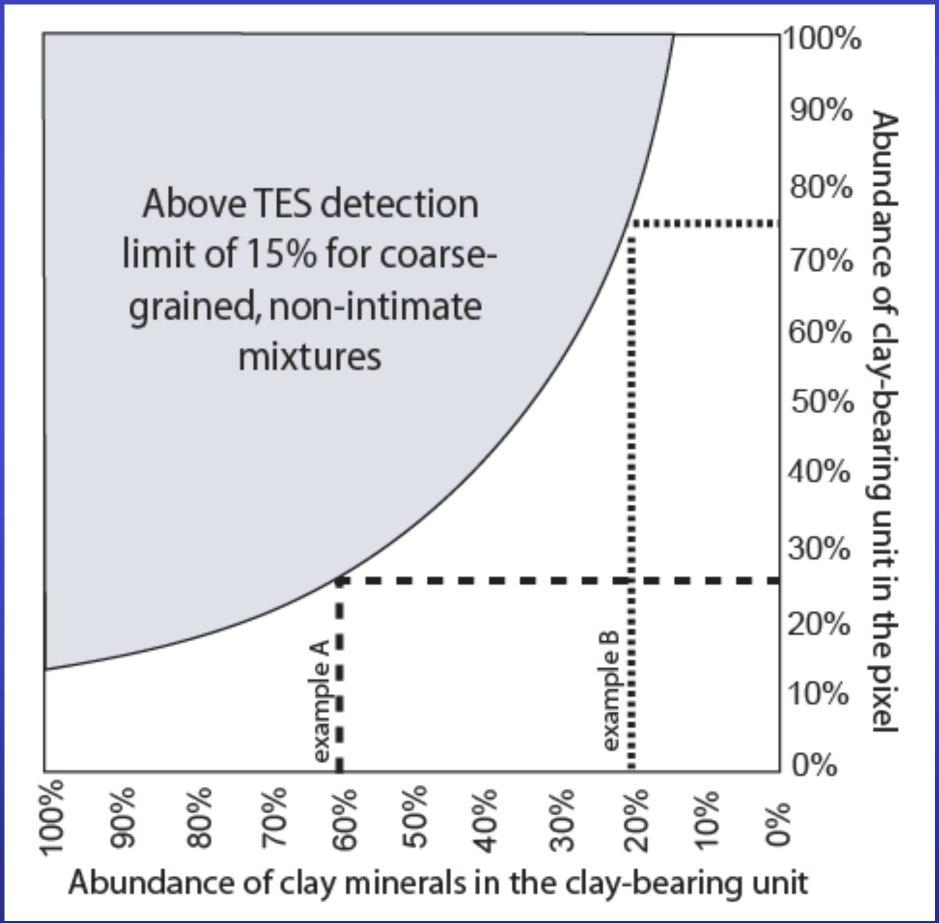
Modeling of TES data: Average spectra of light-toned, intermediate-toned, and very dark-toned surfaces

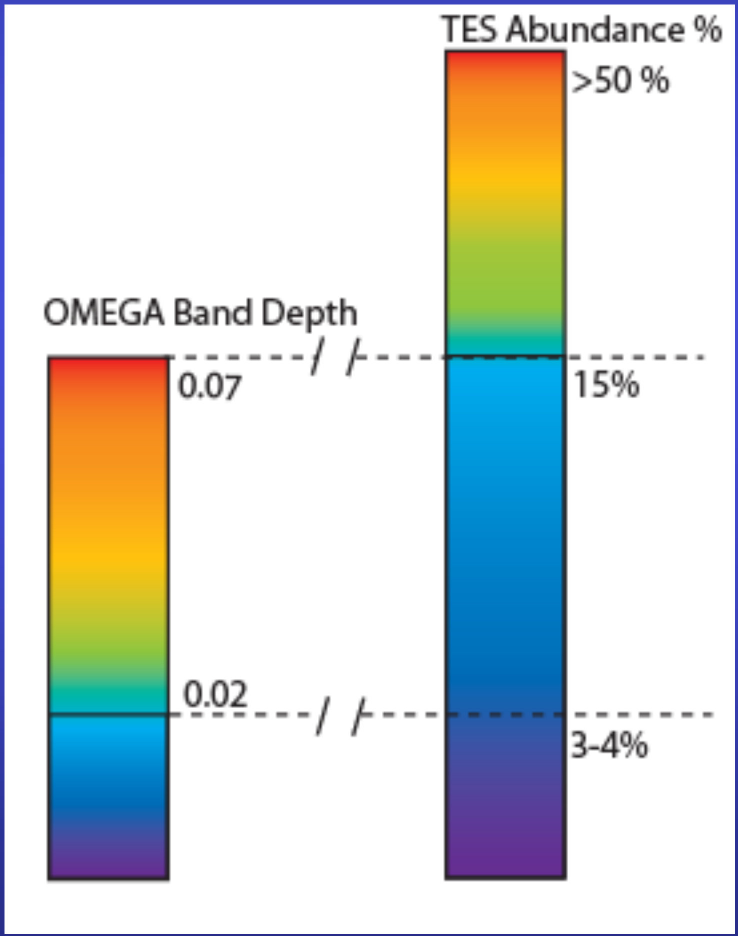


Unmixing results: Full input library at the left and modified input library at the right (to determine which mineral groups are most important to fit the data)

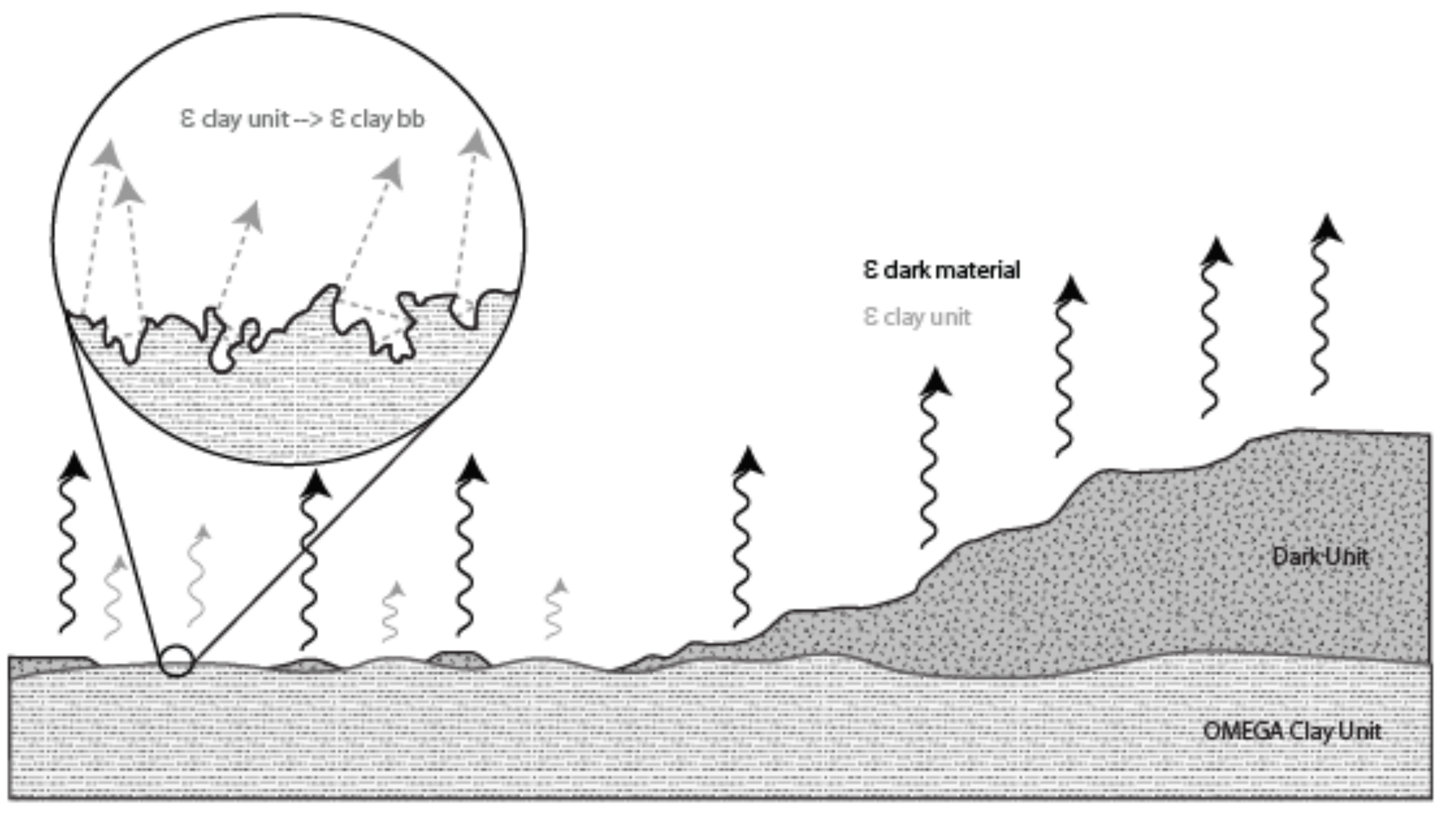
Mineral group	Darkest Regions	Inter-mediate Regions	Light-toned Regions		Light-toned minus Feld	Light-toned minus Pyx	Light-toned minus Silica	Light-toned minus clay	Light-toned minus Zeo
Feldpars	36	44	16		-	12	27	16	17
Pyroxene + basaltic glass	27	9	7		0	-	14	9	13
Silica-rich phases	6	9	37		35	35	-	34	40
Clay minerals	20	18	11		20	18	13	-	15
Zeolites	2	10	13		21	14	27	24	-
Other	9	10	16		24	21	19	17	15
Total	100	100	100		100	100	100	100	100
RMS	0.203	0.249	0.200		0.215	0.200	0.287	0.200	0.209

OMEGA-TES disconnect 1: Actual abundances?





OMEGA-TES disconnect 2: Grain size surface textures

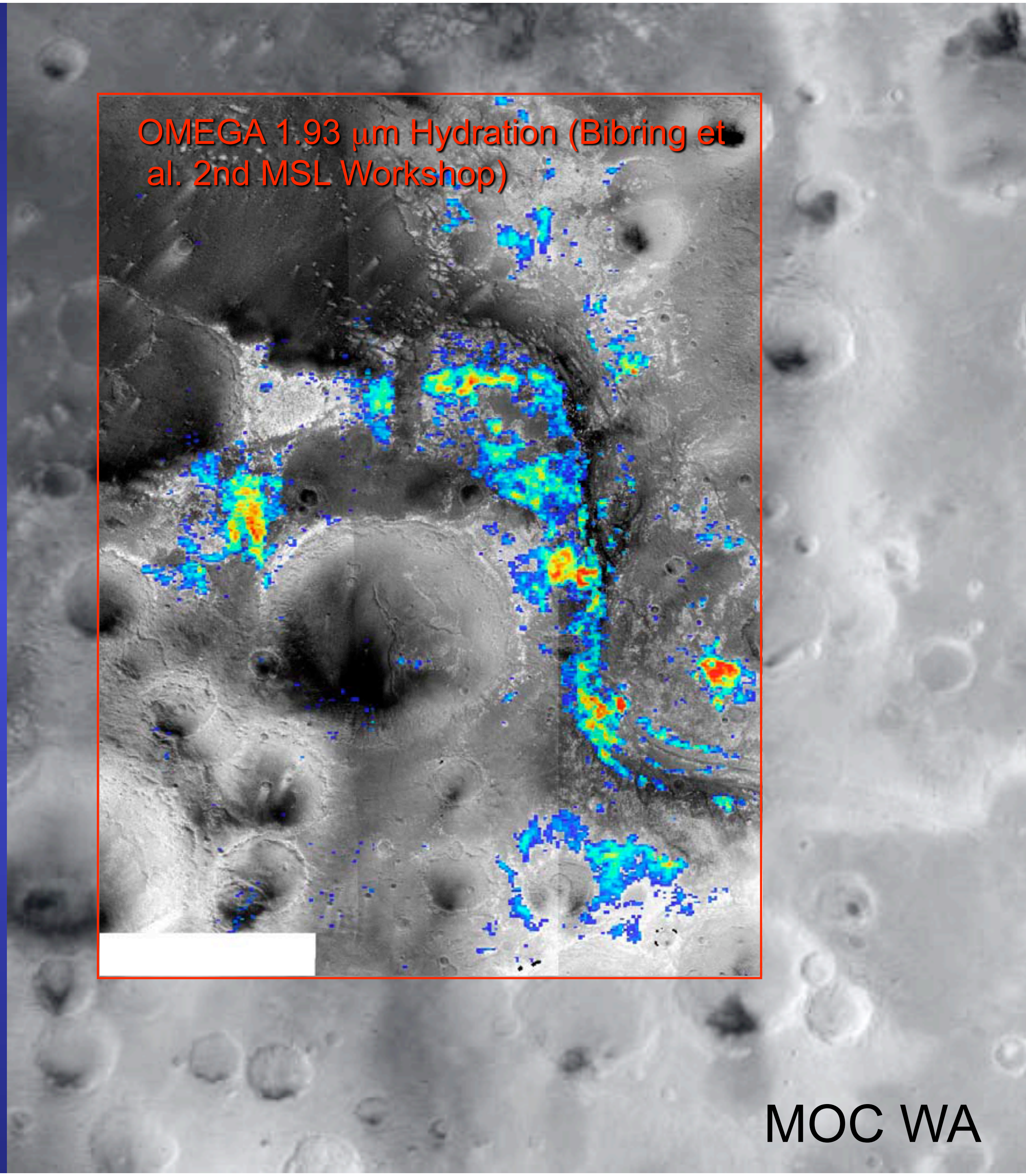


Summary

- Two units in TES/THEMIS data are similar to global surface types 1 and 2
  - Both contain significant plagioclase, pyroxene, and high-silica phases
  - Units are distinguished by inversely correlated olivine/pyroxene and high-silica phase abundance and differences are likely attributed to variable alteration
- NIR phyllosilicate surfaces are within the basalt 2 unit, but exhibit 10-15% higher high-silica phase abundances
- Phyllosilicates observed by CRISM are not detected with TES deconvolution, ratios, or indices
  - The disparity can be attributed to low abundance or texture/particle size effects
- Relatively high albedo, low dust surfaces are present
  - Very unusual for Mars
  - Generally low dust cover (dust increases towards the east)

Mawrth Vallis

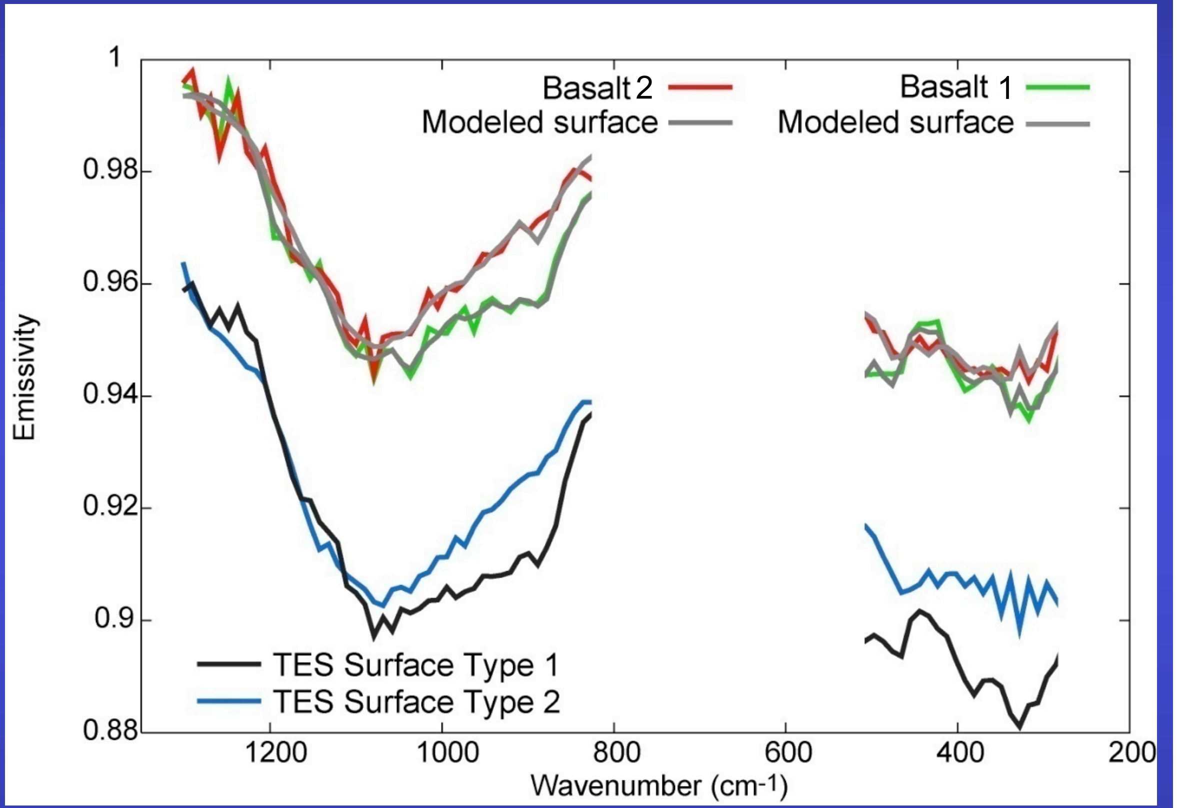

MOC WA


OMEGA 1.93 μm Hydration (Bibring et al. 2nd MSL Workshop)
MOC WA

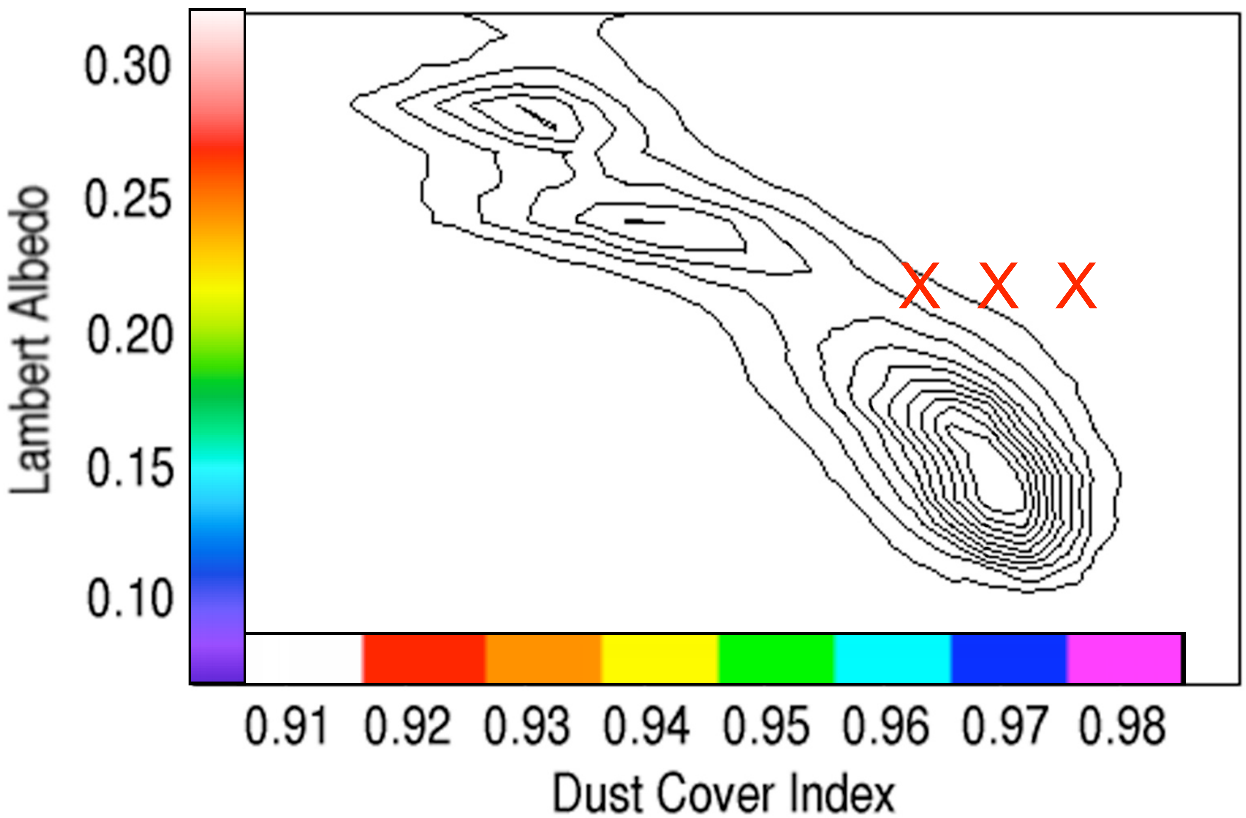
TES analysis of THEMIS spectral units

- All surfaces have significant plagioclase, pyroxene, and high silica phases (~20-30%)

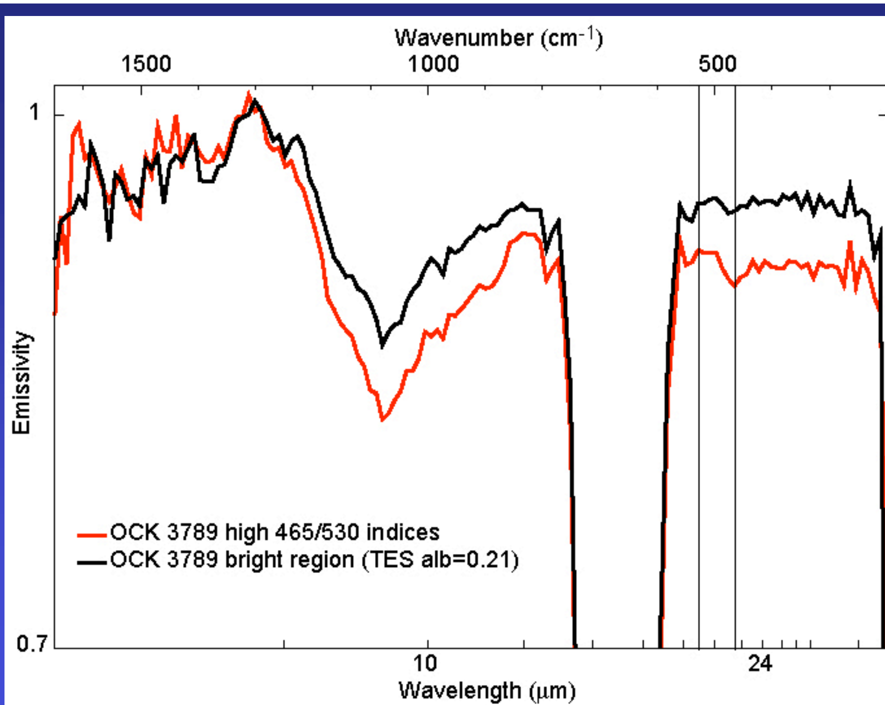
- Olivine/pyroxene are inversely correlated with high-Si phases
  - Similar to global Surface Types 1 and 2
  - Consistent with variable aqueous alteration?
  - NIR phyllosilicate locations have strongest high-Si phase signature (~35% - with no phyllosilicates modeled)

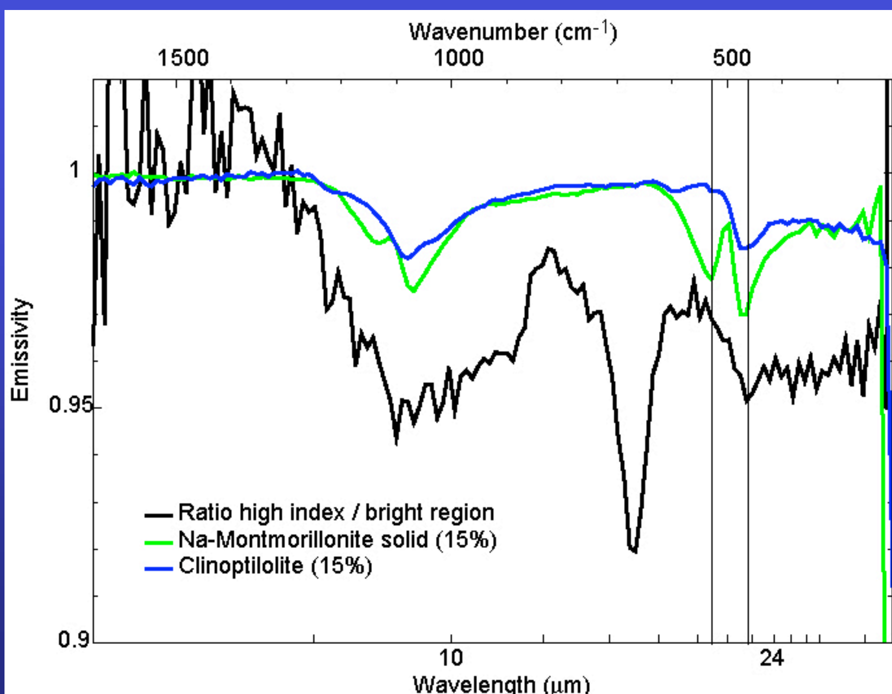


Mawrth Vallis



0.30
0.25
0.20
0.15
0.10
Lambert Albedo
X X X
0.91 0.92 0.93 0.94 0.95 0.96 0.97 0.98
Dust Cover Index





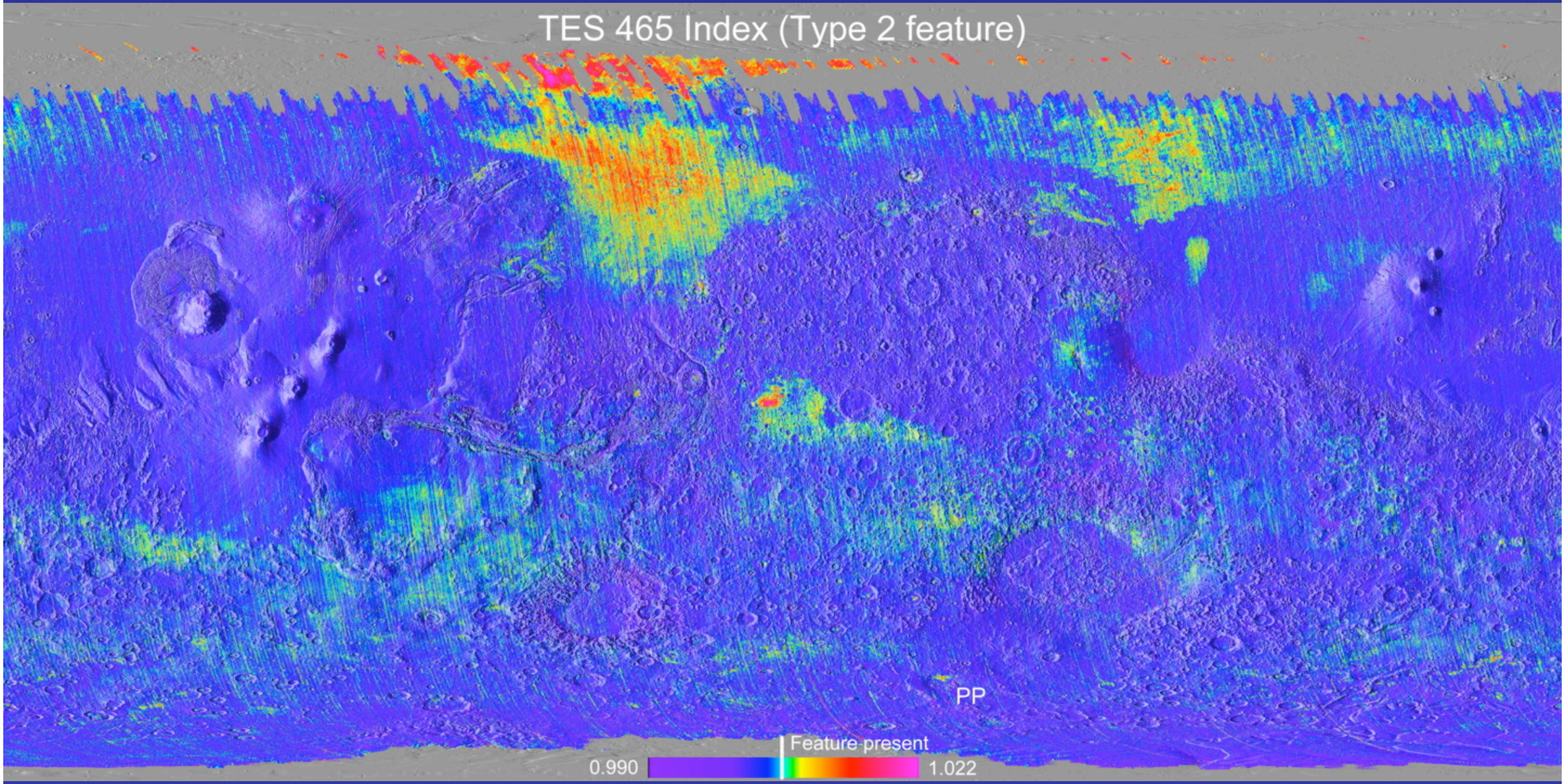
Phyllosilicates

- Ratio spectra and 465 and 530 cm^{-1} indices can give a more precise indication of phyllosilicates

  (*Ruff and Christensen*, 2007)

- Ratio spectrum has strong 465 cm^{-1} feature but smectite doublet is absent
  - upper limit on phyllosilicate abundance: 10-20% (can be much higher if present as loose, fine particles)
  - NIR phyllosilicate regions contain an additional high-silica phase that does not have a smectite doublet (such as amorphous silica or zeolite)

Mawrth Vallis


TES 465 Index (Type 2 feature)
PP
Feature present
0.990
1.022